



Plasma Energy Pyrolysis System (PEPS®) for Destruction of Hazardous Military And Industrial Wastes

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Plasma Energy Pyrolysis Process

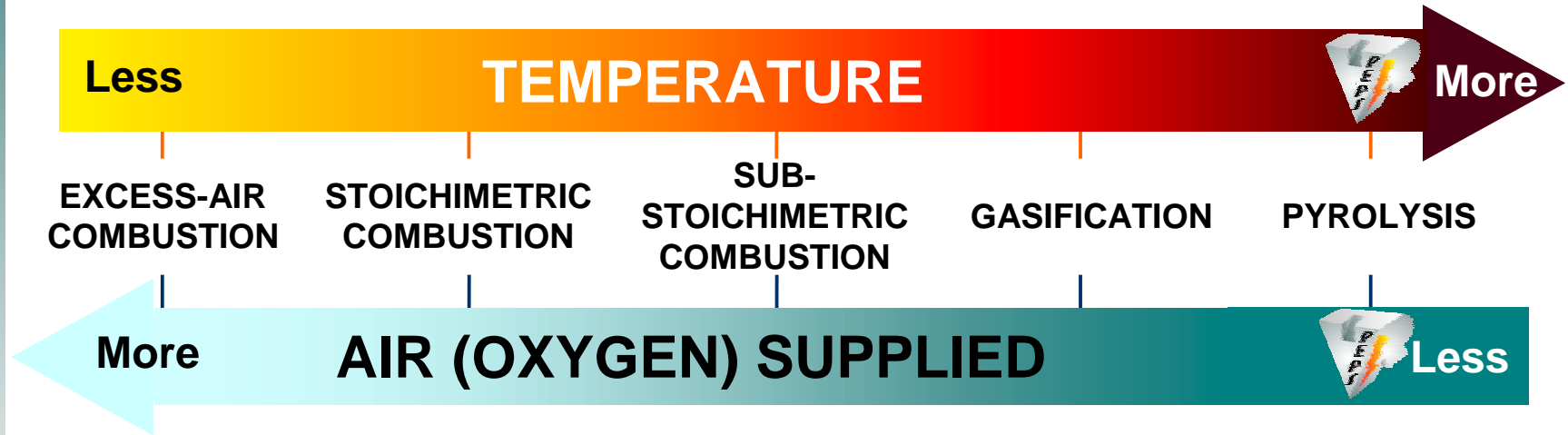
- Plasma is “clean” (massless) heat formed by highly ionizing a gas (air, N_2) using electricity
- High temperature plasma reduces wastes to elements (C, H, O, N)
- Organic compounds (C_xH_y) are converted into syn-gas
- Inorganics are melted and bonded into a non-leaching glassy slag (vitrification)
- Metals can be recovered for reuse
- The oxygen-depleted (reducing) atmosphere prevents burning and limits dangerous by-products (NO_x , SO_x , dioxins, furans)



PLASMA ARC TORCH TECHNOLOGY



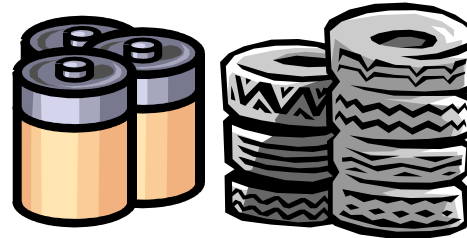
Thermal Processing Comparison



- ♦ **COMBUSTION**: Exothermic, stoichiometric or excess air, fossil fuel
- ♦ **GASIFICATION**: Self-sustaining, reduced oxygen, partial combustion
- ♦ **PYROLYSIS**: Endothermic, external heat source, oxygen-free



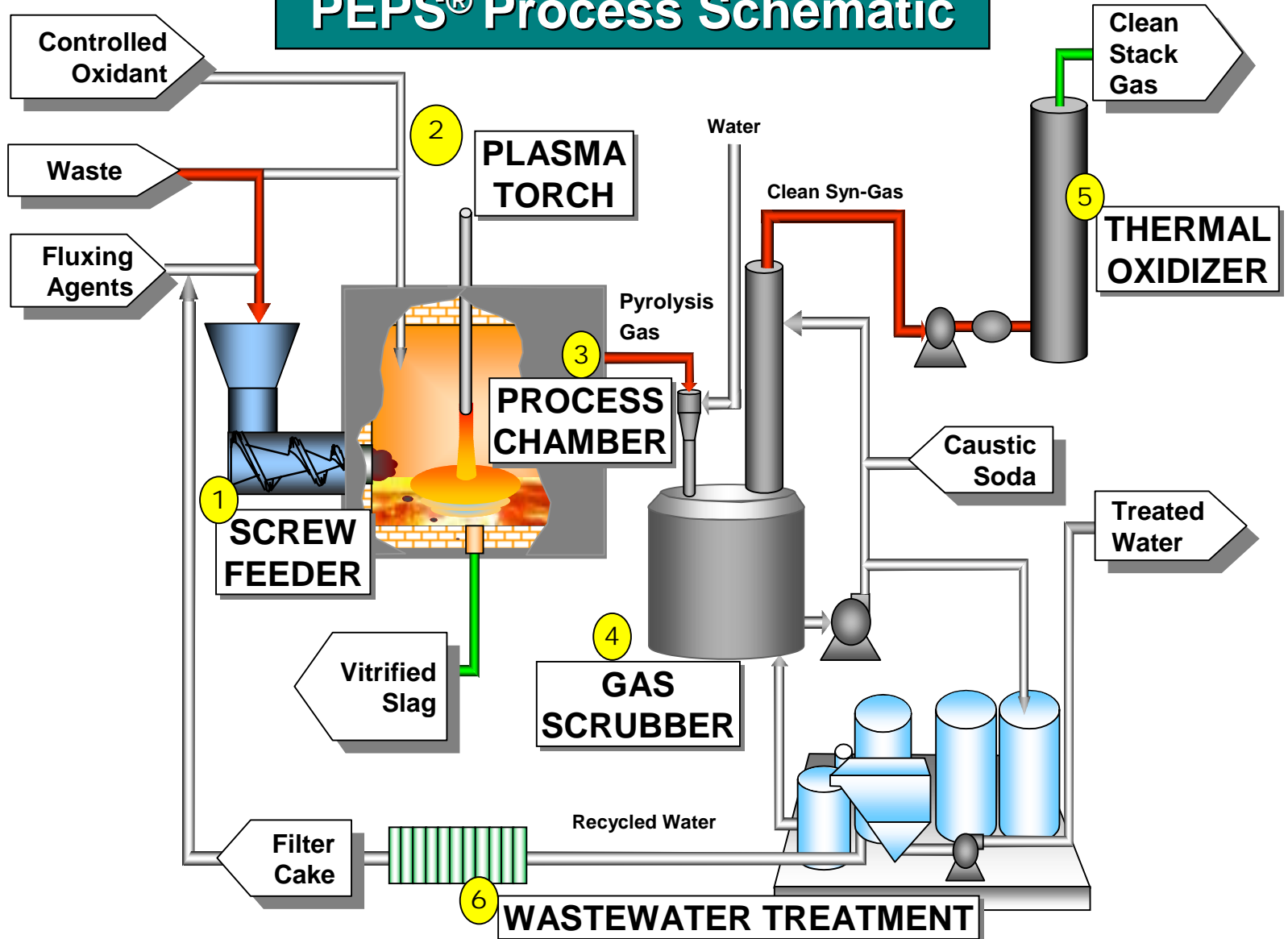
Waste Destruction Applications



- Abrasive Blast Media (ABM)
- Pyrotechnic Ordnance
- Lab Packs
- Vehicle Tires
- Bulk Liquid Organics
- Refuse Derived Fuel
- Industrial Waste Sludges

- Electroplating Sludges
- Medical Wastes
- Thermal Batteries
- Energetic Components & Devices
- Remediation of Industrial Hazardous and Toxic Wastes

PEPS® Process Schematic





PEPS® Process Benefits

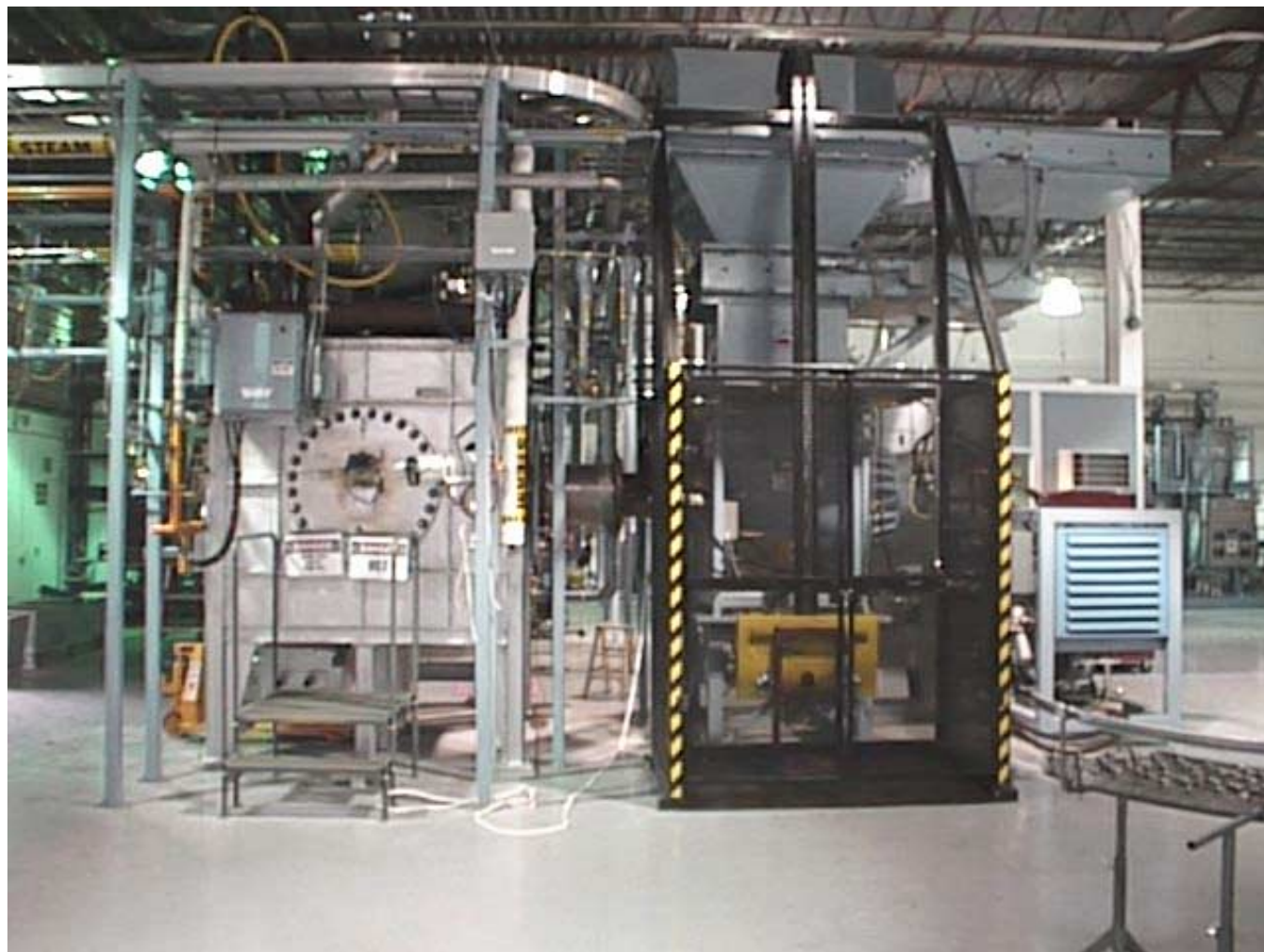
- ◆ **Not Incineration - Controlled Pyrolysis at ~3,000°F**
- ◆ **Permitted as Alternative Treatment Methodology**
- ◆ **Organics in Waste converted into Syn-Gas**
- ◆ **Inorganics in Waste Melted into Glassy By-product**
- ◆ **Complete Destruction of Hazardous Constituents**
 - **DRE > 99.99999%**
- ◆ **Pollutants Below Applicable EPA Emissions Limits**
- ◆ **Non-Leaching Slag Passes TCLP for Heavy Metals**
- ◆ **Potential for Several Energy Recovery Options**



PEPS® Demonstration Facility

Lorton, Virginia, U.S.A.

- Operational Since 1998
- 10 Tons Per Day Installed Capacity
- 500 kW Non-Transferred Arc Plasma Torch
- Wet Scrubber with Wastewater Treatment
- Powered by 1 Megawatt Diesel Generator





Contaminated Agricultural Blast Media



55,500 lbs. Before



245 lbs. After

Regulated Medical Waste



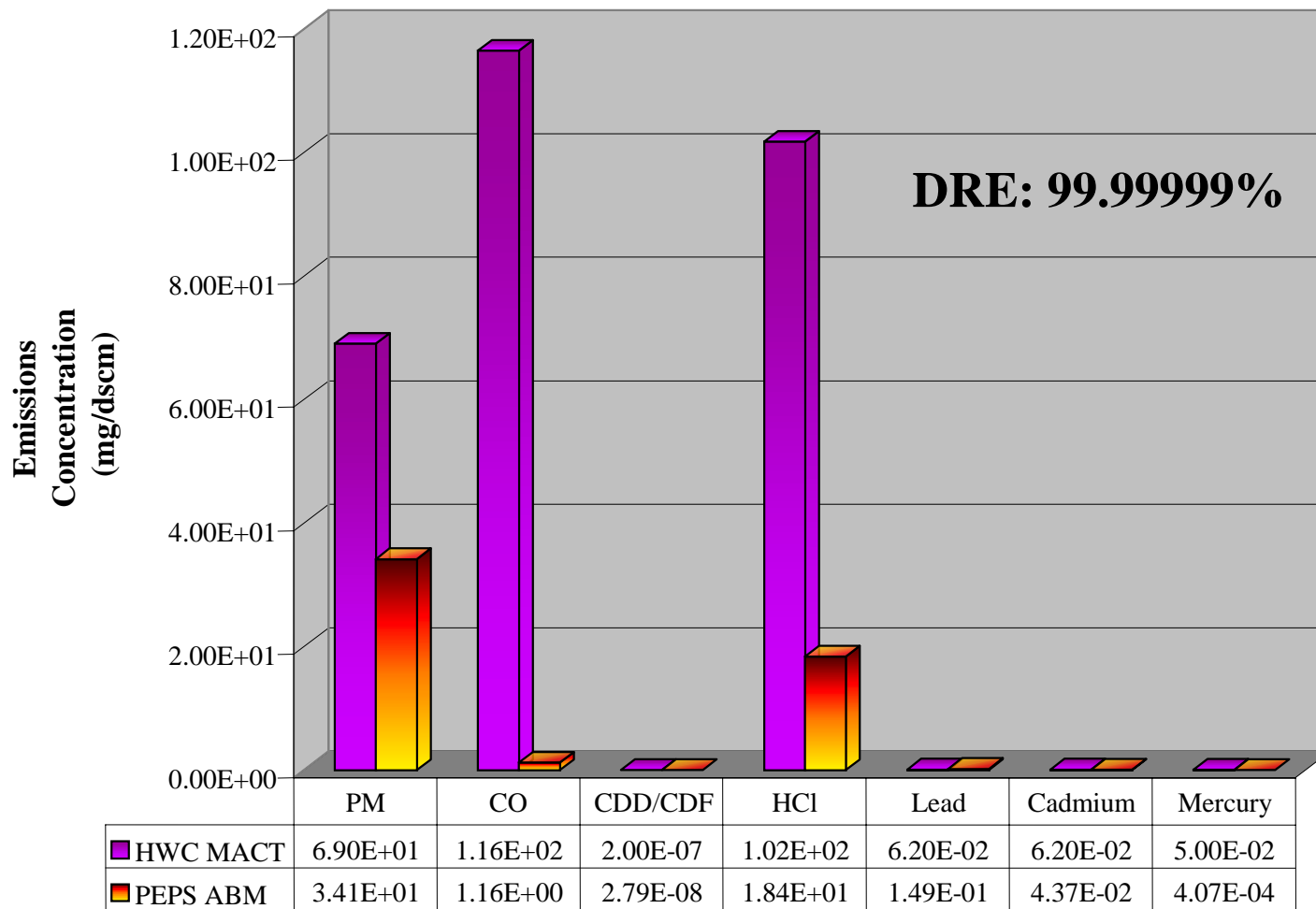
17,000 lbs. Before



250 lbs. After

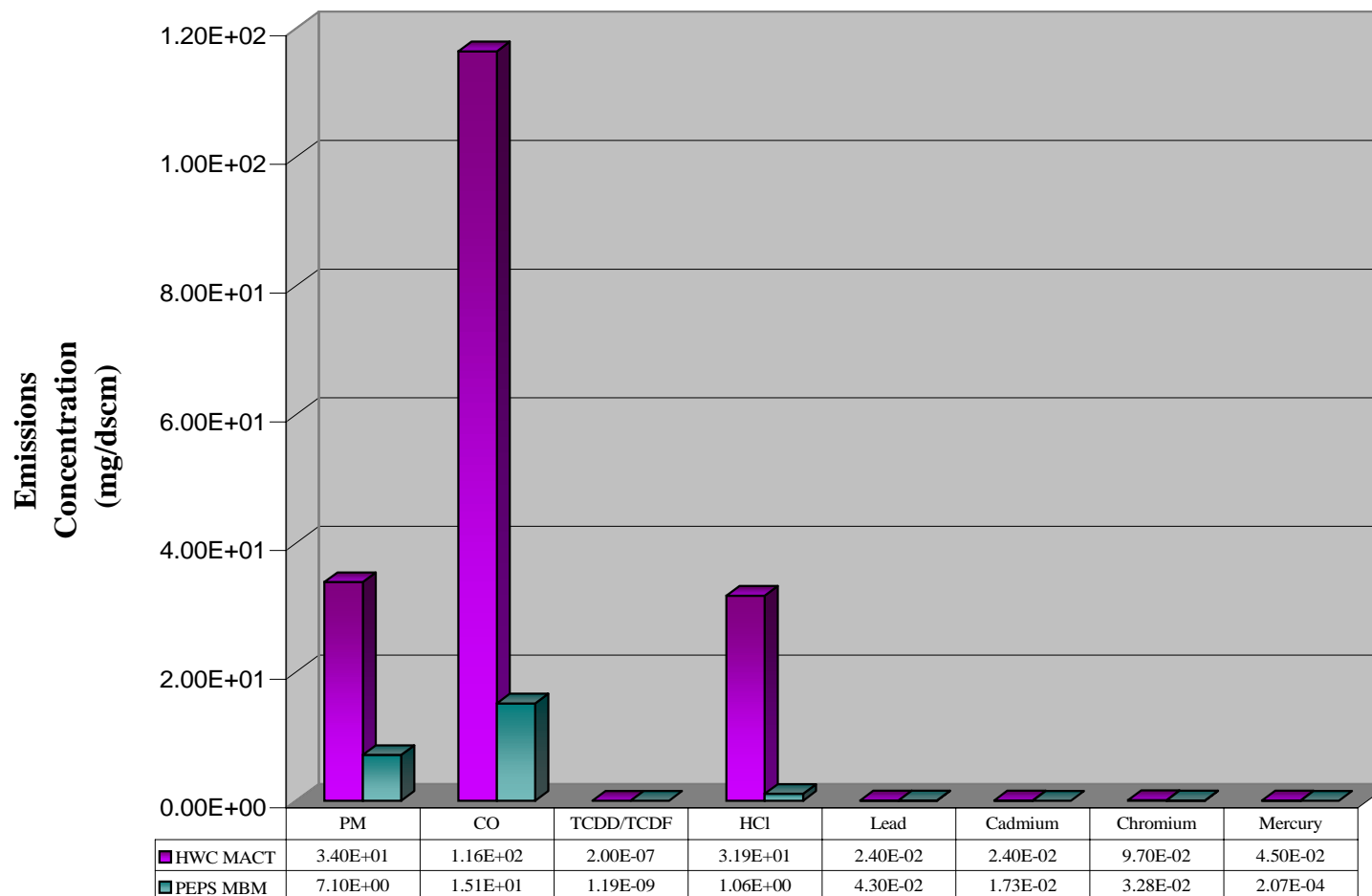


Agricultural Blast Media (ABM) PEPS® Stack Emissions vs. Proposed EPA MACT Standards



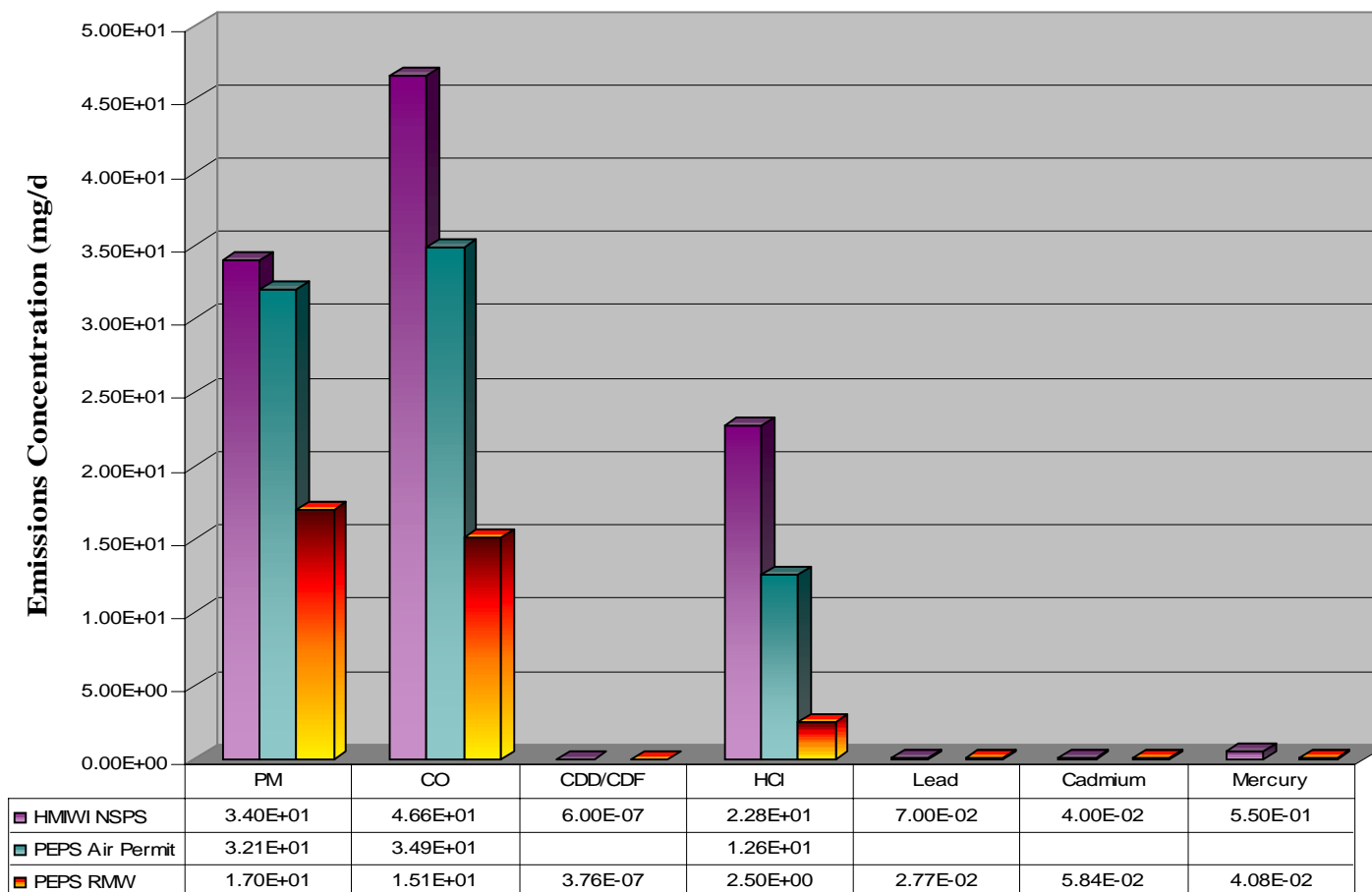


Mixed Blast Media (MBM) PEPS® Stack Emissions vs. EPA MACT Standards



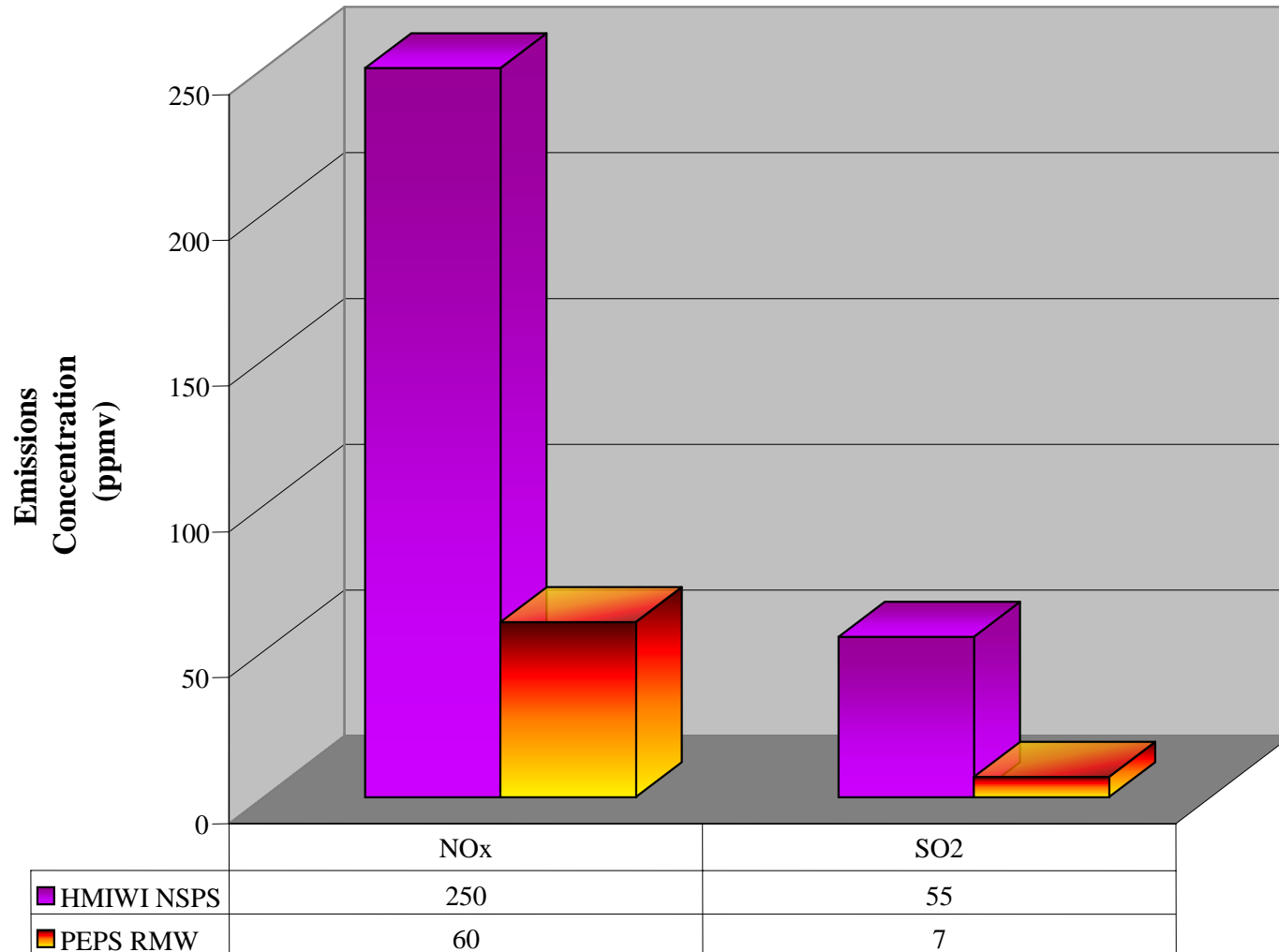


Regulated Medical Waste (RMW) PEPS® Stack Emissions vs. Air Permit and HMIWI NSPS



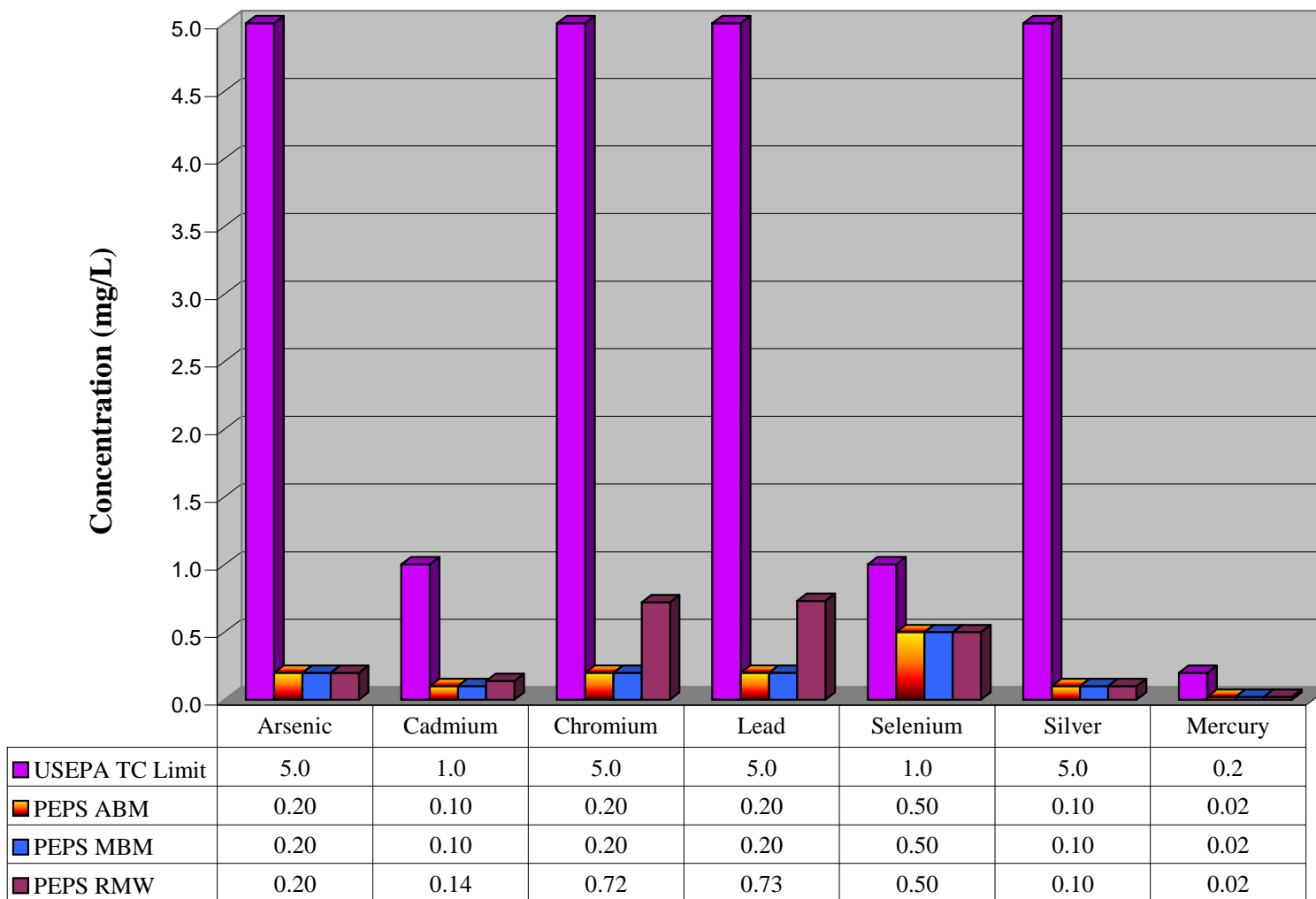


Regulated Medical Waste (RMW) PEPS® Stack Gas Analyzer vs. HMIWI NSPS



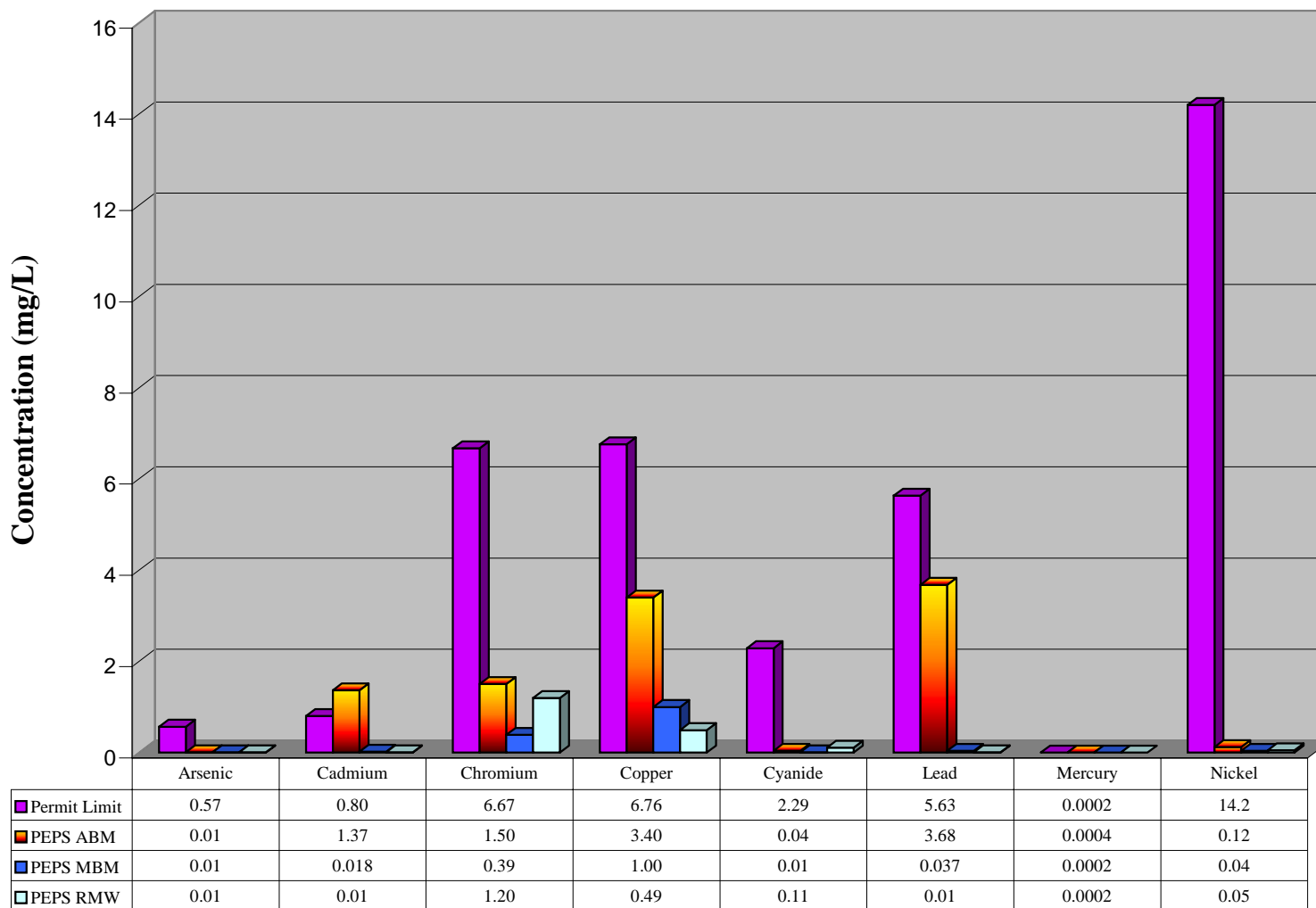


ABM and RMW PEPS® Slag TCLP Results vs. USEPA TC Limits





ABM, MBM and RMW PEPS® Wastewater Effluent vs. Permit Limits (Lorton, VA)





PEPS[®] Advantage

- ◆ **Automated Operation:**
 - PLCs with Windows NT HMI for Operation
 - Fail-safe Design - Minimizes Human Error
 - Minimal Staffing Required - Closed Circuit Video Monitoring
- ◆ **Permitted as a Non-Incineration Process**
- ◆ **Flexible for Waste Processing:**
 - Multiple Wastes (Solid, Liquid, & Sludges)
 - No Presorting, Minimal Manual Handling
- ◆ **Complete Solution**
 - Liability Elimination
 - No Toxic Residue



On-Site Waste Destruction Mobile PEPS®

- No Need to Ship Waste Off-site
- No Requirement for Special Transport Permits
- Simpler Environmental Permit Process
- Quick Set-up and Teardown - Minimum Operating Labor
- Turnkey Equipment Supply or GOCO Operation
- CINC In-Theater Peacetime and Contingency Support





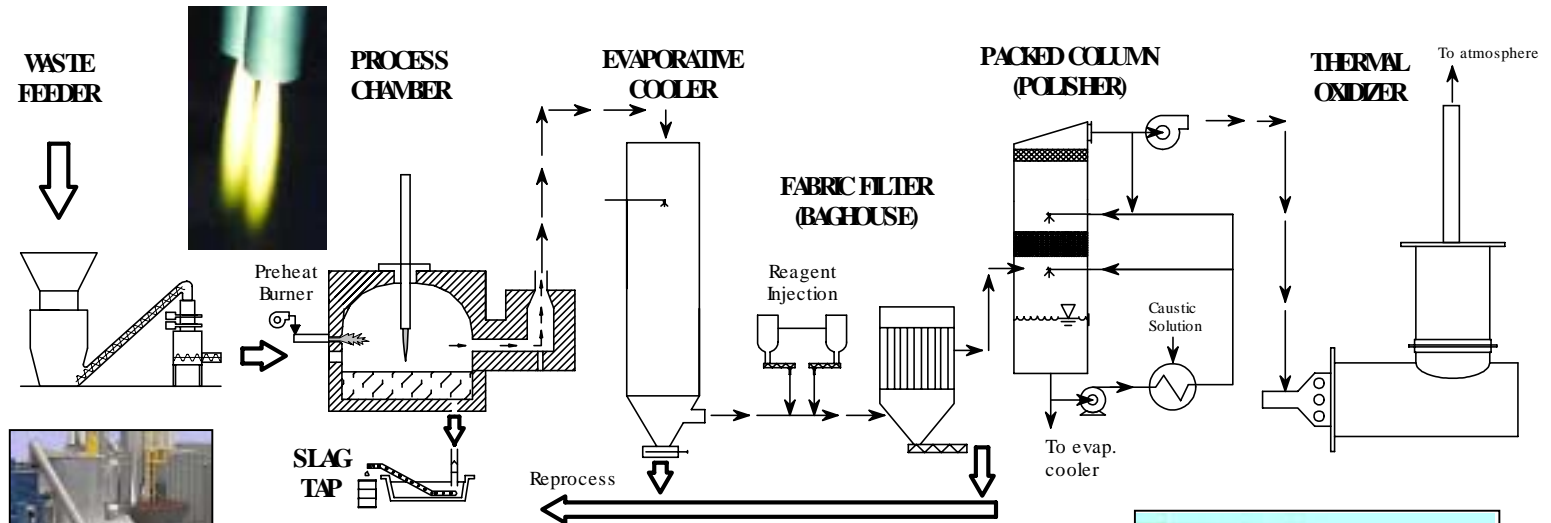
Mobile PEPS®

- ◆ 5 Standard Over the Road 47 ft. Trailers
- ◆ Self Contained
 - Closed Loop Cooling
 - Redundant Onboard Power Source
- ◆ 3 - 5TPD Destruction of Hazardous & Toxic Wastes





Mobile PEPS® Schematic





PEPS® Permits and EA Overview

◆ PEPS® Environmental Permits

- Virginia Minor New Source Review Air Permit
- Regulated Medical Waste (RMW) Off-site Permit-by-Rule
- Hazardous Waste Permit Exclusion for Treatability Studies
- Wastewater Discharge Authorization

◆ PEPS® Environmental Assessment (EA)

- Impact Analysis Conducted for PEPS™ Lorton, VA Facility
- Finding of No Significant Impact (FONSI) June 5, 1998



Air & Medical Waste Permits

- ◆ **PEPS® Minor New Source Review Air Permit**
 - Emissions Evaluation
 - Regulatory Review
 - Medical Waste Regulations
 - Control Technology and BACT Review

- ◆ **PEPS® RMW Off-site Permit-by-Rule**
 - Designated as an “Alternative Treatment” Technology
 - Streamlined Permitting Process



Haz Waste & Wastewater Permits

- ◆ **PEPS® Hazardous Waste Permit Exclusion**
 - Limited Processing of 10,000 kg of waste for treatability study

- ◆ **PEPS® Wastewater Discharge Authorization Permit**
 - Local Limits for Metals
 - Sewer Use Ordinances



Permitting Summary

- ◆ **Streamlined Permits for Short Duration Projects**
- ◆ **Successful Emissions Testing and Performance Validation**
- ◆ **Classified as “Alternative Treatment” Technology for RMW**
- ◆ **Expect Similar Designation for Processing Hazardous Waste Streams**



In Summary

PEPS®:

- ◆ Solves Difficult Hazardous Waste Disposal Problems
- ◆ Certified as “Alternative to Incineration”
- ◆ Provides Benign By-Product
- ◆ Can be “Tailored” to Specific Waste Streams
- ◆ Can be Set up On-Site or Installed On Mobile Trailers
- ◆ Cost Effective on Commercial Scale
- ◆ Ready For On-Site Large-Scale Deployment



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